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Solid Waste Management Program

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Preparation of Solid Waste Facility Closure and Post-Closure Cost Estimates

Guidance

Introduction

The Utah Division of Solid and Hazardous (DSHW) has developed this guidance to provide assistance to landfill owners and operators in preparing closure and post-closure cost estimates. Utah Administrative Code (UAC) R315-302-3 requires closure and post-closure cost estimates. This document is to assist permit applicants in meeting the requirements of R315-302-3, please refer to the rule for specific requirements.

Cost Estimates and Financial Assurance

Closure

Provide cost estimates, in current dollars, for a third party to conduct and complete closure activities (i.e., hiring qualified contractors to perform closure activities). Estimates must equal the maximum closure costs at any time during the life of the facility or cell; or the permit life, whichever is shorter. Estimates must be included for each closure activity. If closure will be conducted in phases provide cost estimates for completing each phase. A sample worksheet for estimating costs is provided. A worksheet with costs for some of the items is also provided. The costs shown were developed for the Oklahoma Department of Environmental Quality and reflect cost in Oklahoma. Basic closure cost items should include, if applicable:

- Gas control system installation, if any is needed in addition to control systems installed in the waste.
- Costs for any additional equipment to treat use or dispose of the gas.
- Final cover installation and material cost including:
    a. Clay material, placement, and compaction.
    b. Vegetative layer material, placement and grading or placement of any other approved layer to protect the compacted soil layer.
    c. Any geomembranes, drainage layers or other cover layers as required by the permit and plans.
    d. Seeding, fertilization, soil amendments and mulch.
- Installation of any additional control or monitoring features as necessary.

Post-Closure

Provide cost estimates, in current dollars, for a third party to conduct and complete post-closure activities. Estimates must equal the maximum post-closure costs at any time during the post-closure period. Estimates should include figures for each post-closure activity and an estimate of the total cost of post-closure care for the thirty-year post-closure period. Include assumptions made in preparing the cost estimates. The basic post-closure cost items should include, if applicable:

- Final cover maintenance and repair. Use the following for estimating the amount of work to be done each year.

  a. Erosion repair; use one foot of cover over 5% of the landfill area per year.

  b. Vegetation repair; use 10% of the landfill area per year.

- Leachate collection, treatment, disposal and maintenance should include costs for:

  a. Operation

  b. Sampling and analyses

  c. Maintenance and repair

- Ground water monitoring should include costs for:

  a. Sampling

  b. Analyses

  c. Maintenance and repair

- Gas monitoring should include costs for:

  a. Sampling

  b. Analyses (if necessary)

  c. Maintenance and repair

- Gas control systems, if required, should include costs for:

  a. Operation

  b. Maintenance and repair

- Any other monitoring or sampling required by other environmental programs should be included in the total cost of post-closure care.

- Record keeping and reporting is required by UAC R315-302-2 and the cost of these activities should be included in the total post-closure care cost estimate.

- Site inspections to oversee cover repairs and post-closure care.

During the active life of the landfill unit and during the post-closure period, the cost estimates for completing closure and conducting post-closure care must be adjusted annually for the rate of inflation or

facility modifications that would affect closure or post-closure care costs. This adjustment is submitted with the annual report, along with other information required for operating or closed facilities.

In developing cost estimates, it may be helpful to enlist the assistance of contractors that could perform closure or post-closure activities. Provide selected contractors with specifications and assumptions and request that they develop the estimates based on your specifications. Copies of documentation of the contractors' estimates should be required. A line-by-line review and calculation along with determination of the average cost for each item should be done based on each contractor's estimates.

If any corrective action program is anticipated during the post-closure period, contact DSHW for more information. A detailed cost estimate and additional financial assurance instrument are required for corrective action.

Additional Information

The initial closure and post-closure plans are submitted as part of a permit application and become part of the approved permit. Subsequent changes due to permit modifications, regulatory changes, operational changes, or unforeseen circumstances (e.g., increase/decrease in fill rate or premature closure with less than the total acreage utilized) which substantially affect the time schedule or costs of closure and post-closure will necessitate closure and post-closure plan and cost estimate modifications. These modifications must be submitted to the Executive Secretary for approval. In addition, adjustments to the cost estimates must be submitted with the annual report and be approved by the Executive Secretary. Any change in the financial assurance mechanism must be submitted to, and receive Executive Secretary approval.

Landfill Closure Cost Estimate Worksheet

A brief description of each line item, as numbered in the tables, is given immediately following this series of tables.

Item		Unit Measure	Cost/Unit	No. Units	Total Cost
1.0	Engineering and Preliminary Site Work				
1.1	Topographic Survey				
1.2	Boundary Survey for Closure				
1.3	Site Evaluation				
1.4	Development of Plans				
1.5	Contract Administration Bidding and Award				
1.6	Administrative Costs for the Certification of Final Cover and Closure Notice				
1.7	Project Management; Construction Observation and Testing				
1.8	Monitor Well Consultant Cost				
1.9	Other Environmental Permit Costs				
1.10	Disposal of Final Wastes				
1.10.1	Disposal Cost				
1.11	Remove Temporary Buildings				
1.12	Remove Equipment				
1.13	Repair/Replace Perimeter Fencing				
1.14	Clean Leachate Lines				
Subtotal					
10 % Contingency					
Engineering Total					

Item		Unit Measure	Cost/Unit	No. Units	Total Cost
2.0	Construction				
2.1	Final Cover System				
2.1.1	Completion of Sidewall Liner				

2.1.1a	Soil Placement				
2.1.1b	Soil Processing				
2.1.1c	Soil Amendment				
2.1.1d	Soil Purchase				
2.1.1e	Soil Transportation				
2.1.2	Drainage Layer on Sidewall				
2.1.2a	Geotextile Filter Fabric				
2.1.2b	Geonet/Geotextile Composite				
2.1.2c	Geomembrane Sidewall Liner				
2.2	Completion of Top Cover				
2.2.1	Infiltration Layer (Compacted Clay				
2.2.1a	Soil Placement (Compacted)				
2.2.1b	Soil Processing				
2.2.1c	Soil Amendment				
2.2.1d	Soil Purchase				
2.2.1e	Transportation				
2.2.2	Geosynthetic Clay Layer				
2.2.2a	Geosynthetic Clay Installation				
2.2.3	Flexible Membrane Cover				
2.2.3a	Flexible Membrane Installation				
2.2.4	Drainage Layer				
2.2.4a	Geonet/Geotextile				
2.2.4b	Sand Layer				
2.2.4c	Soil Cover				
2.2.4d	Geonet/Geotextile Composite				
2.3	Erosion Layer Placement				
2.4	Revegetation				
2.4.1	Seeding				
2.4.2	Fertilize				

2.4.3	Mulch				
2.5	Site Grading and Drainage				
2.6	Site Fencing and Security				
2.7	Leachate Collection System Completion				
	Subtotal				
	10% Contingency				
	Construction Total				

	Item	Unit Measure	Cost/Unit	No. Units	Total Cost
3.0	Gas Collection System				
3.1	System Design				
3.2	Completion of Gas Collection System				
3.3	Equipment and Installation				
3.3.1	Place Sand				
3.3.2	Install Geonet and Geotextile				
3.3.3	Install Passive Vents				
3.3.4	Install, Rework or Replace Gas Control Equipment				
	Subtotal				
	10% Contingency				
	Gas Collection Total				

	Item	Unit Measure	Cost/Unit	No. Units	Total Cost
4.0	Monitor Well Installation Cost				
4.1	Ground Water Monitoring Will Installation, Reworking, or Replacement				
4.2	Install, Rework, or Replace Methane Probe/s				
4.3	Monitor Well, or Methane Probe Plugging				
	Subtotal				
	10% Contingency				

Monitor Well Installation Total				

Calculation of Total Closure Costs

Engineering Total:_____

Construction Total:_____

Gas Collection Total:_____

Ground Water Total:_____

____% Contract
Performance Bond:_____

SUBTOTAL:_____

Legal Fees
(_____% Of Subtotal):_____

TOTAL CLOSURE COSTS:_____

Landfill Post-Closure Care Cost Estimate Worksheet

Item	Unit Measure	Cost/Unit	No. Units	Total Cost
1.0 Engineering Costs				
1.1 Post-Closure Plan				
1.2 Site Inspection and Record keeping (annual)				
1.3 Correctional Plans and Specifications (annual)				
1.4 Site Monitoring				
1.4.1 Ground Water Monitoring				
1.4.1a Ground Water Sample Collection				
1.4.1b Ground Water Sample Analysis				
1.4.1c Ground Water Sample Analysis Review and Reporting				
1.4.2 Landfill Gas Monitoring				
1.4.2a Gas Monitoring Data Collection				
1.4.2b Gas Monitoring Data Review and Reporting				
2.0 Maintenance Costs				
2.1 Cover Maintenance Costs				
2.1.1 Soil Replacement				
2.1.2 Vegetation Reseeding				
2.2 Equipment Maintenance				
2.2.1 Ground Water well Maintenance and Replacement				
2.2.2 Methane Probe Maintenance and Replacement				
2.2.3 Gas Collection System Operation				
2.2.4 Gas Collection System Maintenance and Repair				
2.2.5 Leachate Collection System				
2.2.5a Leachate Collection System Repair and Maintenance				
2.2.5b Clean Leachate Lines				

3.0	Final Plugging of Monitoring Wells				
3.1	Final Plugging of Methane Probes				
3.2	Final Plugging of Ground Water Monitoring Wells				
3.3	Gas Control Equipment Removal				
4.0	Leachate Disposal				
5.0	Site Maintenance				
5.1	Repair of Surface Water Diversion Structures				
5.2	Repair of Fences and Gates				
5.3	General Maintenance				
Subtotal					
10% Contingency					
Post-Closure Care Total					

Total Closure and Post-Closure Costs

Total Closure Costs: _____

Total Post-Closure Care Costs: _____

Total Cost: _____

DESCRIPTION OF LINE ITEMS

Closure Costs
1.0 Engineering

Engineering costs have been divided into seven major items: topographic survey, waste boundary field notes, site evaluation, development of plans, contract administration, bidding and award, administrative costs, and closure inspection and testing. The items may each have a variety of tasks but the nature of the work in the various tasks has been combined in the major items.

1.1 Topographic Survey

A topographic survey will generally be required to ascertain the existing height and top slope of the landfill so that permit compliance can be evaluated and the final closure system, drainage system and final grading can be engineered.

1.2 Boundary Survey

A Boundary survey is a metes and bounds description that is required for filing the closure notice and making the required changes on the record of title on the area of the site which has received waste.

1.3 Site Evaluation

The site evaluation includes a site inspection to identify waste disposal areas, analyze drainage and erosion protection needs, and to determine other site operational features that may not be in compliance with the permit. Analysis of ground water samples, landfill gas analysis, operation records, etc. should also be included.

1.4 Development of Plans

The final closure plan includes the final cover system design and specifications, grading and drainage plans, specifications for revegetation, design of any other site improvements required, and preparation of a closure schedule. This item also includes the coordination of the closure plan with the Utah Division of Solid and Hazardous Waste, including the required notifications and reporting.

1.5 Contract Administration

1.6 Administrative Costs

1.7 Closure Inspection and Testing

Closure inspection and testing costs include the cost of a Professional Engineer to observe the closure construction, perform appropriate cover thickness and permeability verifications, and prepare an evaluation report upon completion of the closure.

1.8 Ground Water Monitor Well Consultant Costs

Consultant costs for monitor well installation include preparation of work plans, well installation observation, well development, and the data analysis report.

1.9 NPDES Construction Storm Water Permit Compliance Package

The consultant is to prepare all necessary plans, specifications, and other documents necessary for compliance with

all applicable federal and state laws and requirements necessary for the closure of the site. One of these required steps is compliance with the Federal Clean Water Act.

1.10 disposal of final Wastes

Any onsite waste that is not in the disposal cell must be placed in the cell or disposed of at a permitted facility if the waste can ton be placed in the current open cell

1.11 Remove Temporary Buildings

Onsite buildings that are not being used for post-closure care operations at the site must be removed and disposed of.

1.12 Remove Equipment

Onsite equipment that are not being used for post-closure care operations at the site must be removed and disposed of.

1.13 Repair/replace Perimeter Fencing

1.14 Clean Leachate Lines

2.0 Construction Costs

Closure construction costs include those for construction of the final cover system, site grading, and drainage improvements. Other construction costs may be necessary to correct on-site problems.

2.1 Final Cover System

The standard final cover system at Class I, Class II, and some Class V Landfills is an infiltration layer that is a minimum of 18 inches thick of earthen material that has a permeability less than or equal to the permeability of any bottom liner system or if there is no liner in the landfill unit, no greater than the permeability of the natural soils, or a permeability of no greater than $1X10^{-5}$ cm/sec, whichever is less, and an erosion layer of a minimum of 6 inches of earthen material that is capable of sustaining plant growth. If a Flexible Membrane Liner (FML) is included in the landfill liner system, it may be necessary to install a Flexible Membrane Cover (FMC) along with the infiltration layer to attain the required permeability. In addition, it is a common practice to place a drainage layer over the infiltration layer to remove water that has percolated through the erosion layer. Also, revegetation of the erosion layer is required to protect the entire final cover system as is revegetation of all disturbed areas.

2.1.1 Completion of the Sidewall Liner

Completion of the sidewall liner is necessary when the waste is not placed at a permanent grade or when no sidewall liner has been placed. In general, if the waste is not placed at a final grade and new final grades have been assumed, the completion of this sidewall liner is required.

2.1.2 Drainage Layer on Sidewall (if required)

For ease of construction, this drainage layer along the sidewall area to be developed could consist of a “geonet” or “geogrid” system and is measured in terms of square yards of placement.

2.2 Completion of the Top Cover

2.2.1 Infiltration Layer (Compacted Clay)

The infiltration layer of the final cover system consists of an 18-inch thick layer of compacted soil or other earthen materials with a permeability matching that of the bottom liner but not greater than $1x10^{-5}$ cm/sec.

2.2.2 Geosynthetic Clay Layer

A compacted clay liner may be used at certain landfill sites to meet the permeability requirements of the rules.

2.2.3 Flexible Membrane Cover

A flexible membrane cover will be necessary at certain landfill sites where the required permeability cannot be attained in the infiltration layer by earthen materials alone. Similar material is used for the FMC as is used for the FML, but typically requires more flexibility and less chemical resistance.

2.2.4 Drainage Layer

A drainage layer is commonly used between the erosion layer and the infiltration layer. Two alternative designs are available:

- The use of a sand layer covered with a geotextile filter fabric; and
- The use of a geonet/geotextile composite.

In either case, a pipe is required around the base of the cover slopes to collect the infiltrated storm water from the drainage layer. The cost of the collection pipe system should be incorporated into the costs for the drainage layer. If a sand layer and geotextile filter fabric are used, then the geonet/geotextile composite item will not be used.

2.3 Erosion Layer Placement

The erosion layer must be a minimum of 6 inches of earthen material capable of sustaining plant growth. The existing site topsoil is generally acceptable for this application, although a layer thicker than 6 inches may be required if the soil used has high shrink/swell characteristics that would promote cracking. Since acceptable soil is generally available on-site, only the cost of placement has been included.

2.4 Revegetation

Revegetation includes the activities necessary to provide vegetative erosion protection over the surface of the completed final cover. In some instances, temporary vegetation measures are used to establish vegetation quickly until permanent revegetation can be developed. The costs are based on seeding with grasses or other shallow rooted plants and the application of appropriate fertilizer. Other methodologies may include sodding, hydro mulch applications, etc.

2.5 Site Grading and Drainage

Site grading and drainage include the final grading of the site, drainage improvements and sedimentation controls for proper closure of the site.

2.6 Site Fencing and Security

Site fencing and security are to be added to secure any area of the landfill which has received waste and is undergoing closure but may not have been fenced.

2.7 Leachate Collection System Completion

In the event of forced closure, there may be circumstances where the leachate collection system has not been completed. In this event, the leachate collection system must be completed with permanent outfalls and permanent clean outs installed.

3.0 Gas Collection System

Some landfill closures may require the installation of a gas collection system. This system may consist of collection pipes, gas collection layer and surface equipment to dispose of or use the gas

3.1 System Design

Where closure is required prior to the complete filling of the cell or site, changes in the design of the gas collection system may be required.

3.2 Completion of Gas Collection System

In the event of forced closure, there may be circumstances where the gas monitoring system, if required, has not been installed completely in association with the unit to be closed. The gas monitoring system may include the installation of pipes and appurtenances necessary for conduction of the required monitoring.

3.3 Equipment and Installation

4.0 Monitor Well Installation

A ground water monitoring well network, if monitoring was required at the landfill unit, should have been installed prior to the beginning of any waste disposal operations. In the event of forced closure of a site, it may become necessary to relocate the point of compliance. This may require the installation of new monitor wells and the proper plugging of those well locations that are no longer suitable. Gas monitoring at the site may require the installation of methane monitoring wells or the relocation or reworking of existing methane monitoring wells.

4.1 Ground Water Monitor Well Installation, Reworking, or Replacement

Monitor well installation, rework or replacement includes all labor (including consultant labor) and materials to do the necessary work including surveying.

4.2 Install, rework, or Replace Methane Probe/s

Methane Probe installation, rework, or replacement includes all labor (including consultant labor) and materials to do the necessary work including surveying.

4.3 Monitor Well or Methane Probe Plugging

Includes all costs for the plugging of wells and probes.

Contingency Costs and Legal Fees

Including in the cost estimates an estimated 10 percent contingency cost and an estimated 25 percent cost associated with the legal fees would be prudent.

Calculation of the Totals for Closure

The Engineering Total, Construction Total, Gas Collection Total, and the Ground Water Total should be added. At that time, a percentage of construction should be set aside for the Contractor's Performance Bond. In addition to that, the 10 percent contingency factor should be built into each category. A space for contingency legal fees has been provided; this may be from zero to as must as 25 percent of the total closure costs.

Please note: These factors are subject to review and may change with subsequent drafts of this document.

Post-Closure Care

The post-closure care period is established to be 30 years or as long as the Executive Secretary determines is required for the facility or unit to become stabilized and to protect human health and the environment. During this period, maintenance must be ongoing to assure the integrity and effectiveness of the final cover and other required systems. Also included in this section is the cost for disposal of leachate, since leachate may still be generated during the post-closure care period. The costs for post-closure care are divided into engineering costs, construction costs and leachate disposal costs.

1.0 Engineering Costs

Engineering costs include the preparation or amendment of a post-closure plan, site inspections, site monitoring, and preparation of correctional plans if required.

1.1 Post-Closure Plan

The post-closure plan provides a schedule for routine maintenance of the final cover system, the landfill security system, and the gas and groundwater monitoring systems. It also contains a schedule for the sampling and analysis of ground water and gas monitoring.

1.2 Site Inspections

Site inspections should be performed at least semiannually and should include identification of areas experiencing settlement or subsidence, identification of erosion or other drainage-related problems, inspection of the fencing, and inspection of the leachate collection system and monitoring Systems.

1.3 Correctional Plans and Specifications

Correctional plans and specifications include the costs for an engineering consultant to prepare plans and specifications to correct problems identified during the site inspections. This cost is obviously dependent upon the quality of care taken during the closure of the site and ongoing maintenance during previous post-closure care years. The cost may be higher during earlier post-closure care years and taper down to zero cost during the end of the post-closure care period.

1.4 Site Monitoring

Site monitoring is the cost to perform semiannual ground water sampling and analysis for each on-site monitoring well. Gas monitoring is performed on a quarterly basis during the post-closure care period and should be included. Any gas collection system that is active may require monitoring can be included here or in section 2.2.3.

2.0 Maintenance Costs

Post-closure maintenance costs include the costs to correct any problems determined by the site inspections and as specified by the engineer's correctional plans and specifications. These costs will also include any ongoing site maintenance that is needed throughout the post-closure care period.

2.1 Cover Maintenance Costs

Subsidence and erosion of the cover may occur. These areas must be repaired and the vegetation reestablished. Also any damage to the compacted soil layer or the FMC, if present, must be repaired.

2.2 Equipment Maintenance

Ground water monitoring wells and any sampling equipment may need repair or replacement. Gas collection system surface equipment may need repair or replacement. Leachate collection system equipment may need maintenance or replacement.

3.0 Final Plugging of Monitoring Wells

At the end of the post-closure care period the monitoring wells must be plugged in accordance with Utah Division of Water Rights rules.

4.0 Leachate Disposal

Leachate disposal costs are difficult to estimate and would be required only at landfills that have a liner and a leachate collection system. Since the landfill will be closed, recirculating of leachate back into the landfill would not be possible. The owner or operator would base cost estimates on an average rate of leachate generation during the past few years of active life of the landfill unit and the cost of treatment that may be available or developed. Another factor that complicates matters, is that, during the post-closure period, the volume of leachate being generated should decrease substantially because the landfill unit has received a final cover.

5.0 Site Maintenance

General maintenance of the site will continue throughout the post-closure period. Items such as fences and gates or other access controls, needed buildings and access roads will need to be maintained.

Landfill Closure and Post-Closure Care Reference Costs

The following are reference costs developed by the Oklahoma Department of Environmental Quality and can be used if no other costs are available.

Closure Worksheet

Item		Unit Measure	Cost/Unit	No. Units	Total Cost
1.0	Engineering and Preliminary Site Work				
1.1	Topographic Survey				
1.2	Boundary Survey for Closure				
1.3	Site Evaluation	lump Sum	$2750.00	1	
1.4	Development of Plans				
1.5	Contract Administration Bidding and Award				
1.6	Administrative Costs for the Certification of Final Cover and Closure Notice				
1.7	Project Management; Construction Observation and Testing				
1.8	Monitor Well Consultant Cost				
1.9	Other Environmental Permit Costs				
1.10	Disposal of Final Wastes				
1.10.1	Disposal Cost	tons	$/ton	5 days of waste	
1.11	Remove Temporary Buildings	lump sum	$2450.00	1	
1.12	Remove Equipment	lump sum	$2000.00	1	
1.13	Repair/Replace Perimeter Fencing	linear feet	$2.20	25% of fencing	
1.14	Clean Leachate Lines	lump sum	$1250.00	1	
Subtotal					
10 % Contingency					
Engineering Total					

Item		Unit Measure	Cost/Unit	No. Units	Total Cost
2.0	Construction				

2.1	Final Cover System				
2.1.1	Completion of Sidewall Liner				
2.1.1a	Soil Placement				
2.1.1b	Soil Processing				
2.1.1c	Soil Amendment				
2.1.1d	Soil Purchase				
2.1.1e	Soil Transportation				
2.1.2	Drainage Layer on Sidewall				
2.1.2a	Geotextile Filter Fabric				
2.1.2b	Geonet/Geotextile Composite				
2.1.2c	Geomembrane Sidewall Liner				
2.2	Completion of Top Cover				
2.2.1	Infiltration Layer (Compacted Clay				
2.2.1a	Soil Placement (Compacted)	cubic yard	$3.20/on-site clay $5.17/off-site clay		
2.2.1b	Soil Processing				
2.2.1c	Soil Amendment				
2.2.1d	Soil Purchase				
2.2.1e	Transportation				
2.2.2	Geosynthetic Clay Layer				
2.2.2a	Geosynthetic Clay Installation	square foot	$0.38		
2.2.3	Flexible Membrane Cover				
2.2.3a	Flexible Membrane Installation	square foot	$0.32		
2.2.4	Drainage Layer				
2.2.4a	Geonet/Geotextile	square foot	$0.27		
2.2.4b	Sand Layer	acre	$30,00.00		
2.2.4c	Soil Cover	cubic yard	$1.50/on-site soil $12.00/off-site soil		
2.2.4d	Geonet/Geotextile Composite				
2.3	Erosion Layer Placement				
2.4	Revegetation	acre	$400.00		

2.4.1	Seeding				
2.4.2	Fertilize				
2.4.3	Mulch				
2.5	Site Grading and Drainage	$/acres	$1122.00	1	
2.6	Site Fencing and Security				
2.7	Leachate Collection System Completion				
Subtotal					
10% Contingency					
Construction Total					

Item		Unit Measure	Cost/Unit	No. Units	Total Cost
3.0	Gas Collection System				
3.1	System Design				
3.2	Completion of Gas Collection System				
3.3	Equipment and Installation				
3.3.1	Place Sand				
3.3.2	Install Geonet and Geotextile				
3.3.3	Install Passive Vents	acre	$500.00		
3.3.4	Install, Rework or Replace Gas Control Equipment	lump sum	5% of equipment cost	1	
Subtotal					
10% Contingency					
Gas Collection Total					

Item		Unit Measure	Cost/Unit	No. Units	Total Cost
4.0	Monitor Well Installation Cost				
4.1	Ground Water Monitoring Will Installation, Reworking, or Replacement	vertical linear foot	25% of wells	$41.40	
4.2	Install, Rework, or Replace Methane Probe/s	vertical linear foot	25% of wells	$35.75	
4.3	Monitor Well, or Methane Probe Plugging	vertical linear foot	25% of wells	$17.75	

Subtotal				
10% Contingency				
Monitor Well Installation Total				

Post-Closure Care Worksheet

Item	Unit Measure	Cost/Unit	No. Units	Total Cost
1.0 Engineering Costs				
1.1 Post-Closure Plan				
1.2 Site Inspection and Record keeping (annual)	lump sum	$500.00	4/year	
1.3 Correctional Plans and Specifications (annual)				
1.4 Site Monitoring				
1.4.1 Ground Water Monitoring				
1.4.1a Ground Water Sample Collection				
1.4.1b Ground Water Sample Analysis				
1.4.1c Ground Water Sample Analysis Review and Reporting	well	$551.00		
1.4.2 Landfill Gas Monitoring				
1.4.2a Gas Monitoring Data Collection				
1.4.2b Gas Monitoring Data Review and Reporting	probe	$35.00		
2.0 Maintenance Costs				
2.1 Cover Maintenance Costs				
2.1.1 Soil Replacement	cubic yard	$2.00/on-site soil $12.00/off-site soil	2 yd^3/acre/year	
2.1.2 Vegetation Reseeding	acre	$400.00	20% of area/year	
2.2 Equipment Maintenance				
2.2.1 Ground Water well Maintenance and Replacement	vertical linear foot	$41.40	25% of wells	
2.2.2 Methane Probe Maintenance and Replacement	vertical linear foot	$35.75	25% of probes	
2.2.3 Gas Collection System Operation				

2.2.4	Gas Collection System Maintenance and Repair				
2.2.5	Leachate Collection System				
2.2.5a	Leachate Collection System Repair and Maintenance	lump sum	$2,000.00		
2.2.5b	Clean Leachate Lines	lump sum	$1,250.00		
3.0	Final Plugging of Monitoring Wells				
3.1	Final Plugging of Methane Probes	vertical linear foot	$14.00		
3.2	Final Plugging of Ground Water Monitoring Wells	vertical linear foot	$17.75		
3.3	Gas Control Equipment Removal				
4.0	Leachate Disposal	gallon	$0.25		
5.0	Site Maintenance				
5.1	Repair of Surface Water Diversion Structures				
5.2	Repair of Fences and Gates				
5.3	General Maintenance				
Subtotal					
10% Contingency					
Post-Closure Care Total					